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EFA NORTHEAST
FIRE PROTECTION ENGINEERING
DESIGN GUIDE

FOREWORD:

The guidance contained herein is provided to assist designers in preparing criteria-compliant, high-quality designs with respect to fire protection. This information includes "lessons learned" on previous projects. Also included is guidance on criteria that are commonly misunderstood or overlooked, and answers to frequently-asked questions. This guidance must be followed, in addition to all applicable codes and criteria (NAVFAC, NFPA, etc.). Deviation from this guidance may be made when necessitated by special conditions upon approval by the NAVFACENGCOM Engineering Field Activity Northeast Fire Protection Engineer. If assistance is needed, please contact the EFA Fire Protection Engineer at(610)595-0585, -0586, or 0613.

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A. GENERAL GUIDANCE:

1. **Mil-Hdbk-1008C, June 1997*)* states all major projects and all projects with fire protection implications "require the services and review of a qualified fire protection engineer."** As a general rule, this means all projects involving modification or construction of a building, pier, wharf, or water supply system require an FPE. A/Es must utilize a fire protection engineer (FPE) from start to finish of design. The FPE must be the lead design professional for ALL aspects of fire protection, and must be responsible for coordinating the activities of other design disciplines as they relate to fire protection. It is preferred that the FPE be a member of the A/E firm selected by the Navy for the project. If the selected A/E firm does not have an FPE on staff, then they must hire an FPE consultant to perform the required functions on all Navy projects. This consultant must be hired before the design process begins. For the definition of a "Qualified FPE", consult Mil-Hdbk-1008*C*, pph 1.5 (a) through (*c*).

2. Mil-Hdbk-1008 requires that designers submit a Fire Protection Engineering design analysis with every 35% and Final submission of every design. This is required to ensure that: (a) Fire protection is included as an integral part of the design process, (b) Fire protection issues receive a central focus for proper coordination at the A/E firm, and (c) design rationale and criteria used are clearly and concisely presented to the reviewer. A good design analysis pays off by creating a better, easier-to-review product, which in turn reduces the need for voluminous review comments and makes everybody's job easier!

3. The most common impediment to good Fire Protection Engineering design encountered by NORTHDIV is lack of coordination. Good coordination between the various design disciplines is crucial. Careful coordination between the specifications and the plans and between various specification sections is equally critical. Good coordination by the A/E can substantially reduce EFA Northeast's review comments. This makes our job and yours much easier!

4. Fire protection guide specifications are criteria. They also contain many useful "how-to" instructions for the designer. Use the guide specs as a design aid from the early phases of each project. Draw the plans to conform to the specs, not vice versa. Edit the guide specs in accordance with their technical notes. Do not make any other changes in specs without prior approval from the EFA Northeast Fire Protection Engineer (FPE).

5. The primary fire protection criteria reference for all DOD facilities is the Military Handbook 1008, followed by the NFPA codes and standards. In the event of conflict between the Mil-Hdbk-1008 and other criteria, 1008 (latest edition) shall govern. EXCEPTION: OPNAV and NAVFAC Instructions, NAVFAC Design Policy Letters (DPLs), and NAVSEA explosives safety criteria (OP-5) have precedence over Mil-Hdbk-1008 if a conflict exists.

6. Use the Mil-Hdbk-1008 as a "road map" to find the appropriate criteria. As a general rule the following criteria are applicable:

a. Building construction type, height and area limits: Uniform Building Code (UBC), 1997

edition.

b. Exit requirements, interior finish, other life safety issues: National Fire Protection Association (NFPA) 101, the Life Safety Code (2000). (Do not use UBC.)

c. Water supply requirements (including sprinkler densities): Mil-Hdbk-1008.

d. Fire Protection Systems: The appropriate NFPA standard(s), as modified by the guide specs.

e. Special hazards (in order of precedence): Military Instructions and Handbooks, then NFPA standards, then Factory Mutual Engineering standards, then any other industry consensus standards.

7. Do not use local codes unless specifically instructed by the EFA NE FPE. By law, the Federal Government is not required to follow state and local fire and building codes on Federally-owned property.

8. There is no "grandfather" clause in NAVFAC criteria. For rehab of existing facilities, fire protection must be brought up to current criteria, commensurate with the scope of the work. By law, a project must provide a "complete and usable" facility, which by definition requires adequate fire protection.

9. An occupancy change requires that the facility meet all fire protection criteria requirements for the new occupancy. Where criteria differentiates between "existing" and "new" facilities, the criteria for a "new" facility must be complied with.

For example: A project which replaces floor coverings only, must provide code-compliant floor coverings. A project which upgrades a building's electrical distribution system must bring emergency lighting, exit signage, and fire alarm system up to current codes. A "whole building rehabilitation" requires the entire building to be brought up to current fire protection criteria.

10. The use of automatic sprinkler systems is mandated by criteria under some circumstances. Where use of sprinkler systems is not mandatory, it is strongly encouraged. When criteria allows use of sprinklers as a tradeoff for a higher fire rating of the construction, the sprinkler option should be chosen where practical.

B. Fire Alarm and Detection Systems:

1. *The EFA Northeast regional hard-wired fire alarm guide specification (N-13852) has been withdrawn. Requirements therein have been incorporated into the NAVFAC guide spec. All projects using hard-wired fire alarm systems must use NFGS-13852 (latest edition).* **For projects where use of addressable systems is authorized by the EFA NE FPE, specification section N-13855 must be used.** *This section is available from the Construction Criteria Base (CCB) under the NORTHDIV regional index. For more information, contact the specification branch head at (610) 595-0576.*

2. Fire evacuation alarm systems shall be provided when required by Mil-Hdbk-1008, Chapters 4-7. As a general rule, they are required for all buildings more than one story in height or that are occupied by 100 or more people. They are also required in any building where a fire detection or suppression system is required.

3. Fire alarm control panels (FACPs) shall be located just inside a main building entrance in a visible, accessible location. Annunciation shall be integral with the FACP. The intent is to allow fire departments rapid access to control panels to pinpoint alarm location and operate system controls. Remote annunciation may also be provided at designer's discretion. Show FACP location on drawings.

4. Building fire alarm control panels shall not be used to control fire suppression systems. Suppression systems shall have separate control panels and detection devices for stand alone capability. EXCEPTION: When the fire suppression system covers the entire building (e.g. a pre-action sprinkler system), it may be controlled by the FACP, provided that the panel is UL listed or FM approved for releasing service.

5. When any initiating device is activated, evacuation alarms must sound throughout the entire building. "Pre-signal" systems, or zoned or partial evacuations are not permitted unless specifically approved by the NORTHDIV FPE where unusual conditions warrant.

6. All circuits shall be monitored for integrity in conformance with NFPA 72. Generally, "Class B" (Style B initiating device circuit; Style W notification appliance circuit) supervision is adequate for hard-wired zoned systems. **For addressable systems**, the signaling line circuits shall be Class A (Style 2, 5, or 6.) Where Class A wiring is specified, the return loop for the wires back to the fire alarm control panel must be indicated and/or specified to be in separate conduit (remotely routed from the outbound leg of the system). When adding to an existing class B supervised system, class B wiring shall be used.

7. Provide a one-line riser diagram of the alarm system on the contract drawings. For conventional zoned systems, show each initiating zone as a separate line. For addressable systems, show signaling line circuits as continuous loops. Show each notification appliance circuit as a separate line. Also show connections to AC power, base alarm system, mechanical (HVAC) equipment shutdown, and door hold-open devices as appropriate. DO NOT show conduit runs or indicate number of conductors on drawing. Do not attempt to show every device on each circuit; instead provide “break” lines in each circuit to indicate that not all devices are shown.

8. Do not run lighting or higher voltage power wires in 24 volt alarm system conduit.

9. Due to their extremely bad track record with the Navy shore establishment, "multiplex" systems shall not be used. Use the simplest technology possible to get the job done! Addressable systems may be used with prior approval of the NORTHDIV FPE for large, complex systems. **For addressable systems, use section N-13855 only.**

10. Manual pull stations shall be located at every exit (and elsewhere if required by NFPA 72). Show locations on drawings.

11. Audible and Visual alarm notification appliances shall be located throughout all corridors, restrooms, and large open areas such as gymnasiums, open-plan offices, warehouses, shops, stores, mechanical rooms, etc. Alarms shall be clearly audible in every occupiable space in the building**. Provide sound level calculations in accordance with the SFPE Handbook of Fire Protection Engineering, 2nd edtion.** Show notification appliance locations on drawings.

NOTE: Compliance with NFPA minimum sound levels in sleeping rooms is required.

12. Base-wide uniformity of audible alarm signals is highly desirable. The designer shall contact the base fire chief to determine which type of alarm device is most commonly in use. When possible, specify recessed bells or flush-mounted horns in buildings likely to receive vandalism, e.g. barracks.

13. If sprinkler control valve tamper switches are provided, they shall be wired to a separate zone on a conventional system or a separate addressable monitor module on an addressable system, as required by NFPA 72. Placing tamper switches on the same zone with water flow devices is **prohibited** by NFPA 72. (Valves which are locked open or which are in locked valve enclosures do not require electrical supervision, per NFPA 13.)

13-A. Always specify a separate zone (or addressable point) for each sprinkler riser water flow alarm.

14. Duct-type smoke detectors shall be provided in air handling systems in accordance with the latest edition of NFPA 90A. Activation of detector shall activate the FACP which shall in turn shut down air handling unit(s), sound building alarms, and notify the fire department. Careful coordination between fire alarm and mechanical/HVAC specifications is mandatory.

14-A. Always specify a separate zone (or addressable point) for each HVAC system's duct detectors, except HVAC units located in the same mechanical room may be combined on one zone or addressable point.

15. When automatic area-wide detection is to be provided, plans shall include a "TABLE" indicating the detector type, temperature rating, room locations, etc. Do not show detector locations on plans or drawings. (Contractors are required to locate detectors in accordance with the performance provisions for the specification). Indicate ceiling heights over 10 feet. On other than smooth-ceiling construction, show beams or joists so that contractor can determine proper detector spacing.

16. Area smoke detection is generally only required for certain life safety applications (e.g. sleeping areas, hospitals, child care centers) and to protect high value electronic equipment. Smoke

detectors require a high level of maintenance to avoid nuisance alarms. D*o not use smoke detectors in facilities where they are not required by criteria without prior approval of the EF*.

17. When area smoke detectors are specified, specify separate zones for detectors and manual pull stations (to enable smoke detectors to be taken out of service for maintenance while keeping manual stations in service). Always specify separate zones for duct detectors on hard-wired systems and separate addressable points for duct detectors in addressable systems.

18. Do not locate smoke detectors where subject to nuisance alarms due to hostile environments, etc. (e.g. dirty or corrosive atmospheres, unheated spaces such as attics and crawl spaces, kitchens, toilet rooms, smoking lounges, laundries, janitor's closets, mechanical rooms, etc.)

19. All concealed smoke detectors (blind spaces, under-floor areas, duct detectors, etc.) shall be remotely annunciated. Show annunciators on drawings, and edit specifications accordingly. *EXCEPTION: Separate annunciators are not required for addressable systems.*

20. When a fire alarm system is being designed for a building where fire or smoke doors can reasonably be expected to be propped open for convenience of occupants or as a necessity of operation, door hold open devices shall be provided in accordance with paragraph 7.2.1.8.2 of NFPA 101, Life Safety Code. Regardless of the hold open method as outlined in the above reference, all doors held open in the same building must release when any one hold open device is required to be released.

21. Fire alarm systems shall be designed in compliance with ADAAG. Examples: Audio-visual notification devices for hearing-impaired persons, manual pull stations at a suitable height for persons confined to wheelchairs, etc.

22. Single- or multiple-station smoke detectors shall be provided in individual sleeping rooms of BEQs, BOQs, Navy Lodges, etc. They shall be 120 VAC powered, hard wired, supplied from an unswitched portion of a lighting circuit within the unit served. Do not provide dedicated AC circuits for detector power. [As an alternate, detectors may be powered by a supervised 24 VDC circuit from the FACP, arranged to sound an evacuation alarm only in the unit of origin, but sounding trouble signals at the FACP in the event of system malfunction.] Use of an isolated heat detector element connected to the building fire alarm system is required for Air Force projects; optional for Navy projects in non-sprinklered buildings.

23. Single- or multiple-station smoke detectors shall be provided in Family Housing as required by NFPA 72 and 101. Provide detectors in bedrooms for all new construction and whole-house rehabs, except bedroom detectors are not required in sprinklered housing. Detectors shall be 120 VAC powered, hard wired, supplied from an unswitched portion of a lighting circuit within the unit served. For new construction and whole-house rehabs, when more than one detector is required within a single living unit, all detectors in that unit shall be interconnected to sound an alarm at all detectors within the living unit when any one detector is activated. Do not provide dedicated AC circuits for single- or multiple-station smoke detectors.

Use EFA Northeast guide specification N-13854, Household Fire Warning Equipment, for all residential smoke detector installations.

24. Radio or telegraphic master fire alarm boxes shall be placed in accessible, visible, high-traffic exterior locations. Show location on drawings.

25. For areas to be equipped with systems furniture having partitions greater than 48" in height, indicate mounting of visible notification appliances as high as possible without exceeding the NFPA 72 maximum height of 96" to the top of the lens, or show ceiling-mounted visible appliances.

C. EXIT AND EMERGENCY LIGHTING:

1. Exits shall be marked as required by NFPA 101 with internally illuminated "EXIT" signs. Provide additional signs in all means of egress (with directional arrows as appropriate) as required to make the direction of travel to the exits readily apparent from any location within the means of egress. Show locations on drawings. Pay particular attention to the need for additional ceiling-mounted directional signs in areas where corridor layouts are formed by systems furniture partitions.

2. "EXIT" signs shall be electrically powered from an unswitched circuit on the building system, with battery back-up. Use of radioluminescent type signs is prohibited, except as permitted in NAVFAC Design Policy Letter DPL-88-0008. Use Light Emitting Diode (L.E.D.) type signs. Do not use incandescent-lamped signs.

3. Emergency lighting shall be provided in all normally occupied buildings where artificial lighting is required for normal use and occupancy in accordance with NFPA 101. Show locations of emergency lighting units.

4. Emergency lighting shall be provided by battery powered emergency lights connected to the supply side of the light switch in the area served, **so that emergency lighting will activate when primary lighting in the area served is lost**, even if power remains on in the remainder of the building.

5. Provide emergency lighting throughout the means of egress and in hazardous areas such as mechanical rooms. Aisles between systems furniture in open-plan office areas which are considered means of egress must be provided with emergency lighting the same as for fixed-walled corridors in traditional floor plan buildings. Provide outside remote lamps to illuminate exterior exit discharges as required by NFPA 101.

D. ELEVATORS:

1. Smoke detectors for elevator recall must be installed in accordance with NFPA 72 and must be part of the electrically supervised fire alarm system. Provide detectors for recall in all machine rooms and lobbies. Detectors must be arranged to recall the elevators per ANSI A17.1 and must also activate the fire evacuation alarm system.

2. When elevators are located in fully sprinklered buildings, the following requirements (per NAVFAC Design Policy Letter DPL-91-0003) must be included in the appropriate contract drawings and specification sections:

a. Provide intermediate-temperature sidewall automatic sprinklers in the elevator pit on a branch line fed from the building sprinkler system. Sprinklers must be located not more than 4 feet above the pit floor and below all non-waterproof electrical equipment.

b. Provide intermediate temperature sprinklers in the elevator machine room. Provide a supervised indicating control valve, check valve and water flow switch without retard device in the branch line supplying those sprinklers. Locate the control valve in a readily accessible location outside the machine room. Activation of the sprinklers in the machine room shall cause the main power to the elevators controlled from that machine room to be automatically disconnected without time delay. For dry-pipe systems, in lieu of the flow switch, provide heat detectors with a Response Time Index (RTI) lower than that of the sprinkler heads to disconnect power prior to water flow. SHOW DETAILS ON DRAWINGS.

c. Automatic sprinklers are not required at the top of the elevator hoistway except where a roped hydraulic or a holeless hydraulic elevator has been installed, or where a hydraulic elevator's pressurized supply line runs at points above the first landing level. If automatic sprinklers are installed at the top of the hoistway, their activation ~~does not~~ require shutdown of the main power supply to the elevators.

d. Provide a warning sign and audible signal in the cab of each elevator. The warning sign shall be a minimum of 3" x 4" and shall be mounted prominently in, above, or adjacent to the car's operating panel. The sign shall not be obscured by the elevator's protective pads, if any. The warning sign shall have a blank face so that it cannot be read when it is not illuminated. The sign shall read "DANGER! FIRE! EXIT ELEVATOR NOW!". The audible signal shall be clearly audible over normal ambient noise while the elevator is in motion. The power source for the warning sign and audible signal shall be supplied from the elevator's main controller.

e. The warning sign and audible signal shall be activated by a 135 deg. F rate-compensated heat detector mounted in the elevator machine room. Mount the heat detector adjacent to the sprinkler head, or equidistant between sprinkler heads when there is more than one sprinkler head in the machine room.

f. **All wiring and power sources shall be monitored for integrity** by the fire alarm system as required by NFPA 72 section on elevator control.

E. SPRINKLER AND STANDPIPE SYSTEMS:

1. Sprinkler systems must be provided in all new family housing, BOQ, BEQ, dormitory/hotel/motel/apartment, and similar projects regardless of any other criteria. This is Federal law. Sprinkler systems shall also be provided in these occupancies during major renovations (for family housing, defined as unit construction cost exceeding 70% of the unit replacement cost). Sprinkler systems shall also be provided where required by any provision of Mil-Hdbk-1008 Chapters 3, 4, and 6, occupancy-specific military criteria, NFPA 101, or the UBC.

For multi-family housing sprinkler systems, design systems to comply with NFPA 13R, not 13D, when there are more than 2 dwelling units per building. EXCEPTION: When pairs of units are separated by 2-hour rated masonry fire walls with no penetrations, use 13D. For 13D systems

only, use NORTHDIV specification N-13951, Residential Fire Suppression Sprinklers.

For BEQ/BOQ type housing, use NFPA 13R where applicable, **EXCEPT** follow NFPA 13 (with quick-response heads in dwelling units) in combustible buildings and buildings exceeding 4 stories high.

1a. All new/major renovation buildings greater than one story height which are accessible to persons with severe mobility impairments as defined by NFPA 101 must be provided with sprinkler protection throughout per Mil-Hdbk-1008, pph 6.1.2(k) regardless of any other criteria.

2. If sprinkler protection is required on a project, **the A-E** (or their subcontractor) must conduct water flow tests at the proposed site. Include pertinent test data and demand analysis in the 35% design package. **Water supply test data shall not be provided by the Government. Tests shall be conducted in accordance with NFPA 291 *Fire Flow Testing and Marking of Hydrants.***

3. **The A-E is responsible for analysis of the water flow test data to determine if the water supply available is adequate to meet sprinkler and hose stream demands.** This analysis must be submitted for review by the EFA NE FPE no later than the 35% review submission. If fire flow demands cannot be met, the A/E's design must provide proper solutions to the problem (i.e., booster fire pump(s) and/or water storage tank(s)and fire pump(s)). It is imperative that possible problems and solutions be identified as early as possible. See MIL-HDBK 1008 for required sprinkler densities and hose stream allowances.

a. Regardless of whether sprinkler system is to be designed by hydraulic calculations or pipe schedule, water supply must be verified as adequate.

b. Hydraulic calculations shall be used for design of all new systems covering greater than ***1,500*** square feet. Minor modifications to pipe schedule systems shall be by pipe schedule where possible. All modifications to hydraulically designed systems must be calculated.

c. Only flows from pumps that are automatic starting or constantly running shall be used when specifying available water supply for automatic sprinkler systems. State in the design analysis which pumps, if any, were running during flow tests, and whether they started automatically or manually.

d. When analyzing available water supplies, allowances must be made for large industrial or domestic water demands (which may be intermittent) including those from other nearby facilities. Deduct these from the available water supply if tests were taken when these demands were not present on the distribution system.

e. When conducting water flow tests directly from fire hydrants, use orifice coefficients of 0.6, 0.7, or 0.8, depending on the shape of the outlet, in accordance with ~~Factory Mutual Engineering~~ NFPA 291 criteria.

f. Where water supplies are strong enough to permit, reduce actual field water flow and pressure readings by 10% before inserting into specification. This allows some "safety factor" for future deterioration of supply.

g. When estimating sprinkler flow demand, multiply density times hydraulically remote

area, then add 10% safety factor. **Factory Mutual Data Sheet 2-77 provides an acceptable method for estimating the demand of most sprinkler systems.**

*4. If sprinkler water supply is from a nonpotable source (e.g. river, lake, pond, or ocean) this fact must be clearly noted on the drawings and in the specification. For example: "NOTE: SPRINKLER SYSTEM IS SUPPLIED WITH RIVER WATER. PROVIDE RETURN BENDS OR DRY PENDANT HEADS AS REQUIRED BY NFPA 13."

5. No new sprinkler system shall be designed for less than ordinary hazard group 1 (0.15 GPM/SQ.FT.). Exception: Residential sprinklers designed per NFPA 13R or 13D.

6. For new systems, do not show sprinkler piping layout or head placement on contract drawings. Interior sprinkler piping layout shall be done by the contractor based on the performance specification. For minor modifications to existing systems (such as relocation of heads to clear new lighting fixtures), piping layout and head placement may be shown. Contract drawings shall show underground feed main and sprinkler risers (schematic one-line riser diagram), but not interior sprinkler heads and piping.

7. Sprinkler protection for all areas must be included under the sprinkler specification section. Do not specify sprinklers under separate sections for special areas such as trash chutes, paint spray booths, etc. Ensure sprinklers for spray booths and elevator machine rooms and hoistways have separate indicating shutoff valves as required by NFPA 33.

8. Sprinkler risers must be controlled by Indicating Valves. Where feasible, use outdoor post indicating valves (PIVs). Otherwise, use wall indicating values or OS+Y values. When space permits, locate PIVs at least 40 ft from building, as required by NFPA 24.

9. Where sprinklers are located in high value or high voltage electronics areas, electronics power must automatically shut down upon sprinkler head waterflow. Coordinate between sprinkler, fire alarm, and electrical sections.

9-A. Where sprinkler heads are located in an elevator mechanical equipment room, a separate branch line serving that room only must be provided. The branch line must have: (1) An indicating, normally-open shutoff valve, (2) A check valve, and (3) A flow switch with no time delay device. For additional requirements, refer to Section D Elevators.

10. Underground sprinkler feed mains shall be no smaller than 6" size (except residential sprinklers installed per NFPA 13D). Depth of bury shall be as per pph 8-1.1 and figure A-8-1.1 of NFPA 24.

11. Sprinkler feed mains shall not be used for domestic water supply, except as authorized by the NORTHDIV FPE (except residential sprinklers installed per NFPA 13D or 13R).

12. Do not use electric-motor-operated valves in fire suppression systems. Use listed deluge valves. Listed water motor-operated valves may be used to control foam concentrate in foam systems.

13. Alarms shall be initiated by pressure switch on top of retard chamber for dry-pipe, deluge, and preaction systems. Vane or "paddle"type flow switches shall be used in wet pipe systems only.

Provide water motor gongs on all systems.

14. Anchor rods shall be provided at the base of each sprinkler riser per ~~figure A-2-9.1 of~~ NFPA 13 and ~~figure A-8-6.2(1)~~ Section 8-6 of NFPA 24. Show these rods on riser details on contract drawings.

15. Provide fire department pumper connections for all new systems and significant system modifications. Locate these connections where readily accessible to fire apparatus. Ensure that there is a hydrant within 150' of each pumper connection. (See also Section J.) **NOTE FOR NAS WILLOW GROVE ONLY:** Specify and show on plans a pumper connection with a single 5-inch "Storz" fitting in lieu of siamese fitting.

16. Do not use or specify "on-off" intermittent sprinkler heads without prior approval from the EFA NE FPE

17. Sprinkler heads below a combustible pier or wharf shall be pendent heads installed in the upright position, or "old style" heads. Specify accordingly.

18. If sprinkler protection is required, 100% coverage must be provided. Partial sprinkler systems are not permitted. EXCEPTION: Limited service systems protecting isolated hazards such as laundry chutes are acceptable when there is no requirement for sprinkler protection throughout the remainder of the building.

*18-A. In buildings containing combustible concealed spaces (e.g. combustible rafters or ceiling above suspended ceiling, this must be explicitly noted on drawings. For example: "NOTE: PROVIDE SPRINKLERS IN COMBUSTILBE SPACE ABOVE SUSPENDED CEILING AND BELOW CEILING AS REQUIRED BY NFPA 13." (We've had lots of change orders when this was not done.)

19. Sprinklers provided primarily as a life-safety measure, such as sprinklers in hospital patient rooms, bedrooms (BEQ, BOQ, Navy Lodge, etc.), should be commercial-type (k=5.6) Quick Response sprinklers as defined by NFPA 13. Sprinklers used in all other areas (including "public" or common areas of the above named buildings) shall be standard spray sprinklers. Sprinklers installed in one- and two-family housing shall conform to NFPA 13D.

20. Backflow prevention for fire protection system connections to potable water supplies shall conform to NAVFAC manual for *Cross-Connection Control Program Implementation at Navy Shore Facilities, May 1997*, which shall be implemented as follows:

a. Backflow prevention for potable water systems which do not contain chemicals and do not have a fixed connection to a non-potable source shall be provided with an approved double check valve assembly (DCVA), unless state environmental law requires a reduced pressure zone (RPZ) backflow preventer.

b. Systems containing chemicals (e.g. antifreeze or foam) and connected to a potable water system shall be provided with a reduced pressure backflow preventer (RPZ).

c. Systems connected to both a potable water main and a non-potable auxiliary source

(e.g. water storage tank where the water is not maintained to drinking water standards), shall be provided with a reduced pressure backflow preventer (RPZ)on the potable connection.

d. Backflow preventers shall be installed over water-tight floors with floor drains to a sanitary sewer. RPZ relief outlets shall be piped (through appropriate air gap) directly to a sanitary sewer.

e. Systems supplied from a non-potable source only, shall be provided with an alarm check valve, dry pipe valve, or deluge valve and do not require any additional backflow prevention unless necessary for proper hydraulic function of the system.

20-A. To facilitate compliance with the NFPA 13 requirement for a full-flow test of backflow prevention assemblies, all new systems designed for densities greater than 0.15 gpm/sq.ft. shall have test valves installed downstream of the backflow preventer. These valves shall be angle or globe valves with 2 ½-inch male National Standard Hose Threads with cap and chain (similar to valves installed on standpipes). Show these valves on the one-line riser diagram and include them in the sprinkler specification. Provide one valve for each 250 gpm and fraction thereof of system design flow (e.g. 450 gpm requires 2 valves).

21. WARNING !!! Backflow prevention assemblies MUST NOT be retrofitted to existing fire protection systems until a complete engineering analysis of the hydraulics of the existing system is completed. Most existing systems cannot tolerate the additional friction loss (pressure drop) caused by a backflow preventer, and require remedial measures (such as installation of a fire pump) to compensate for this loss. Failure to provide these remedial measures may cause the system to fail during a fire.

22. Ensure that sprinkler main drains are arranged to discharge outside the building onto paved surfaces or concrete splash blocks whenever possible. If necessary to discharge to a floor drain, size the floor drain to handle full flow from a 2-inch drain at the maximum expected system pressure.

23. Supervisory air pressure in pre-action system piping shall be specified as not to exceed 10 psi.

24. Specify galvanized steel pipe for all new dry-pipe sprinkler systems, except where the ambient temperature exceeds 130 degrees F, in accordance with Factory Mutual Data Sheet 2-8N. Fittings need not be galvanized.

25. Use the EFA NE regional guide specification NFGS-N-13975, [Dry] [Wet] Standpipes [and Hoses] for all projects requiring standpipes, INCLUDING combined sprinkler/standpipe systems.

26. Class I fire department standpipe systems shall be provided in all buildings greater than 3 stories in height in accordance with NFPA 14.

27. For Class I standpipe systems in buildings up to 75 feet tall, if total system flow required by NFPA 14 does not exceed 1,000 gpm, and calculations show that the required flow and pressure can be supplied by a fire department pumper, do not provide a fire pump to boost distribution system pressure to required standpipe system pressure. Provide a fire hydrant of adequate capacity within 150 feet of the standpipe pumper connection to readily facilitate supply of the standpipe by the pumper.

28. Design Class I standpipes for residual pressure of not less than 100 psig at the most remote

outlet at full design flow per NFPA 14. If fire apparatus is being counted upon to boost standpipe pressure, begin calculation at the pumper outlet,assuming a discharge pressure of 150 psig, and a pump capacity of 1,000 gpm unless otherwise directed.

29. For combined sprinkler & Class I standpipe systems, adequate pressure and flow for the sprinkler system must be automatically available. If a booster fire pump is required to boost distribution system pressure for sprinkler system operation, size pump for sprinkler flow only (but not less than 500 gpm.)(See items 27 & 28 above.)

F. GASEOUS EXTINGUISHING SYSTEMS:

1. Gaseous extinguishing systems shall not be used as substitutes for required sprinkler protection for any facility unless a waiver has been obtained from the NAVFAC Chief Fire Protection Engineer through the EFA Northeast FPE.

2. Use of Halon for protection of Naval Shore facilities is prohibited by the Chief of Naval Operations.

3. For those facilities where total flooding Halon would previously have been provided, provide: (a) a supervised automatic wet-pipe, dry-pipe, or pre-action sprinkler system at the ceiling level (also above ceiling if combustibles are present); and (b) a supervised smoke detection system at the ceiling, under the raised floor (if any), and above the ceiling if that space contains combustibles; and (c) a supervised automatic carbon dioxide flooding system under the raised floor if that space contains exposed nonmetallic sheathed cables; and (d) portable fire extinguishers consisting of both carbon dioxide and pressurized water types. NOTE: The smoke detection system may be part of a pre-action system and/or the carbon dioxide system in lieu of providing duplicate systems. Any detector or manual pull station activation in the protected space shall activate the pre-action system. Only activation of under-floor detectors or designated pull stations shall activate the carbon dioxide system. NOTE: Building alarm notification appliances may serve as first stage (pre-discharge) alarm notification for underfloor CO_2 systems; separate pre-discharge alarms are not required.

4. Carbon dioxide total-flooding (room flooding) systems shall be restricted to use in normally unoccupied spaces such as generator rooms, battery rooms, water-reactive HAZMAT storage, etc. Total flooding carbon dioxide shall not be used in occupied areas such as computer rooms. NOTE: For total-flooded spaces, separate pre-discharge, discharge, and post-discharge alarm notification appliances are required.

5. Systems shall be automatically actuated by cross-zoned smoke detectors (*In unheated areas or hostile environments, use single-zone heat detectors instead of smoke detectors.)*. The sequence of operation shall be as specified in NFGS 13961 (old 15361), summarized as follows:

a. Upon actuation of the first detector (pre-discharge mode):

(1) Pre-discharge alarms shall activate in the protected area(s).

(2) The general building fire alarm must activate. (Provide general building

evacuation alarm notification appliances within the space.)

(3) An alarm signal shall be transmitted to the Fire Department.

b. Upon actuation of the second detector (discharge mode):

(1) Discharge alarms (distinct from the pre- discharge and building alarms) must activate in the protected area(s).

(2) Air handling equipment serving protected area(s) must shut down, prior to start of agent discharge.

(3) All doors and any required dampers to the protected area must close, prior to start of agent discharge.

(4) A time delay relay (set at minimum 15 seconds) shall start, at the end of which:

(a) Discharge will occur in area or zone where alarm initiated.

(b) Tech power in the affected area or zone must shut down.

(c) Visual indicators (i.e., signs with lit face or flashing light above) outside the entrances to the area or zone must activate, indicating that re-entry is prohibited.

c. Consider specifying ionization smoke detectors on one zone and photoelectric smoke detectors on the other zone of a cross-zoned system for maximum range of fire detection capabilities.

d. Upon actuation of a single manual station, all functions of the pre-discharge mode and the discharge mode shall occur, including time delayed discharge.

e. All manual stations shall be distinct (i.e., signs, different color) from manual alarm stations and manual stations for other extinguishing systems.

f. No new hose reel systems shall be installed in any buildings, except by direction of the EFA NE FPE.

6. On Air Force projects ~~only~~, positive hand pressure abort switch can be provided and shall be located within the protected area. No abort switch shall be included in Navy projects unless specifically approved in advance by the EFA NE FPE.

7. Self contained rescue breathing apparatus shall be provided outside all rooms protected by total ~~flooding~~ Carbon Dioxide (CO2).

8. Ensure spaces protected by gaseous extinguishing systems are tightly sealed to prevent leakage. Construction joints must be caulked. Pipe and conduit penetrations must be sealed. In total flooded rooms, doors must have sweeps and weather stripping and ceiling tiles must be clipped down. Show these types of precautions on drawings appropriate for each trade.

9. Provide a dedicated exhaust system to remove the discharged agent and products of combustion directly to the outside atmosphere. System shall be manually activated and interlocked with the extinguishing system to prevent operation of the exhaust for at least 10 minutes after the system has discharged.

10. DO NOT locate storage containers for extinguishing gas within the hazard area or within a means of egress. Do not locate storage containers below grade (below the level of exit discharge) unless a sensing/alarm system is provided to warn of accumulations of carbon dioxide caused be a leak.

11. Use of Halon-substitute gasses is not permitted, except where special circumstances warrant as determined by the EFA NE FPE. If use is approved, base specification on either NFGS-13996 or -13961, making only changes necessary to accommodate new agent.

G. DRY OR WET CHEMICAL SYSTEMS:

1. Except in individual residential units, all open griddles, deep fat fryers, charbroilers and associated exhaust hoods must be protected with automatic extinguishing system(s). The protection for duct only may be omitted if an approved grease extractor is provided in the duct. Grease extraction system shall be interlocked to activate upon operation of extinguishing system. For protection of deep-fat fryers using vegetable oils, use wet chemical systems only.

2. All systems must be arranged to sound the building fire alarm system (where existing) and shut down all appliances under the protected hood. When a building does not have an alarm system, the system must sound a local audible alarm, and alert the fire department directly if an exterior alarm reporting system exists.

3. The final acceptance test must include discharge of the propellant gas. Edit the specification accordingly.

4. Each extinguishing system must have at least one manual activation station. All manual activation stations shall be clearly labeled to distinguish them from manual fire alarm stations and manual stations for other extinguishing systems.

5. Hood exhaust fans shall not be shut off unless specifically required by U.L. listing or F.M. approval of the extinguishing system.

6. Prior approval must be obtained from the EFA NE FPE before using dry or wet chemical systems for protection of other types of hazards. These systems are not acceptable substitutes for required sprinkler protection.

H. FOAM SYSTEMS:

1. Foam systems are used for the protection of flammable and combustible liquid hazards such as aircraft hangars, bulk storage tanks, warehouses, hazardous waste facilities, truck/rail car/barge loading or unloading facilities, and similar hazards.

2. All Navy systems shall be designed to use Aqueous Film Forming Foam (AFFF) as the extinguishing agent. Where alcohol-based liquids may be stored or handled, design for the use of polar solvent resistant type AFFF.

3. **AIRCRAFT HANGARS:** DOD intentionally deviates from NFPA 409 regarding extinguishing systems in aircraft hangars. NFPA 409 requires overhead foam deluge protection for all Group I hangars. NFPA 409 defines Group I hangars as including those which house strategically important military aircraft as determined by DOD.

DOD deviates from the requirement for an overhead deluge system because of the large number of open-cockpit (e.g. fighter) aircraft and high dollar losses experienced from accidental discharge of overhead foam deluge systems.

In all other respects, compliance with NFPA 409 is required.

NAVY & MARINE CORPS HANGARS:

Instead of providing overhead deluge systems, provide low-level in-floor AFFF systems using Navy Floor Nozzles as the primary extinguishing system. In addition, a closed-head pre-action water sprinkler system at the ceiling/roof level as a supplemental system designed for a minimum density of 0.17 gpm/sq. ft. over the most remote 15,000 sq. ft. must be provided. Its purpose is to cool the building and prevent structural collapse in the event the low-level extinguishing system fails to control the fire for any reason.

Navy floor nozzles shall be located on 25-foot centers along trenches in trenches 50 feet apart. Trenches along end walls shall be 20 feet out from the wall to avoid blockage by storage against the walls. Design density shall be 0.10 gpm/sq. ft. over the entire hangar floor. Zoning of systems for actuation purposes is permitted.

Because rapid knock-down of a fuel spill fire is critical to preventing destruction of aircraft, actuate the low-level primary system by cross-zoned triple-spectrum IR optical fire detectors. Activation of a foam system manual release station, and/or overhead heat detectors (where present), and/or water flow in the overhead system, shall also cause activation of the low-level AFFF system.

AIR FORCE & AIR GUARD HANGARS:

Follow ETL 01-2. Provide overhead preaction water sprinkler systems and Hi-Expansion Foam system.

Hi-X foam system shall be actuated by overhead heat detectors, by water flow in the preaction system, and by clearly marked and guarded manual stations. Optical fire detectors shall be for alarm only.

4. **Do not use diaphragm-pressure ("bladder tank") proportioners on closed-head foam systems or with in-line balanced pressure proportioners (ILBPs)**. Use pumped balanced pressure or in-line balanced pressure proportioning to ensure adequate foam production at low flows and through long runs of concentrate piping.

5. FOAM PUMPS MUST HAVE TWO INDEPENDENT SOURCES OF ELECTRICAL POWER (with automatic switchover). Electrical power must comply with NFPA 20 for fire pumps. Disconnecting all electrical power to the building shall not disconnect power to electric pumps. (See Section I. Below.)

6. Controllers for foam pumps must comply with NFPA 20. Supervision and remote monitoring of pumps and controllers must comply with NFPA 20 and NFPA 72. (See section I below.)

7. Emergency generator installations shall conform to NFPA 110. Controllers and engines shall be remotely monitored as required for fire pumps by NFPA 20 .

8. For diesel-engine-driven pumps and/or generators, **ensure that adequate combustion air intakes are provided into the pump/generator room.** Combustion air shall not be taken from inside the building. If supply of combustion air requires electrical power (e.g. to operate dampers or fans), two reliable sources of power with automatic switchover (see Item I.1-A below) must be provided.

9. For density of application, follow the appropriate NFPA standard (e.g. NFPA 30 for flammable liquid storage).

10. When designing foam protection for petroleum storage tanks, provide semi-fixed system as defined in NFPA 11 after verifying that the fire department legally obligated to provide protection has the capability of proportioning foam at the required rate for the required duration. If they do not, specify a complete fixed system, with automatic fire detection, but manual discharge actuation.

11. When designing foam protection for petroleum storage tanks, do not use subsurface injection. Use tank-side foam chambers.

12. There is no guide specification for Hi-X foam systems. Utilize the AFFF guide specs as a basis for creating a Hi-X foam system spec.

13. Specify Hi-X foam generators with water-motor-powered fans vs. electric-motor-powered fans .

I. FIRE PUMPS:

1. All fire pumps which constitute the sole source of fire water supply shall be diesel driven unless the installation is provided with two completely separate, reliable sources of electricity with automatic switching in compliance with Chapter 6 of NFPA 20.

1-A. When **two electrical feeders** are used as the two separate power sources, they **must follow diverse routing to the pump** from two separate substations fed from two geographically remote connections to the looped public power grid, **so that no single accident can disrupt both power sources simultaneously**.

2. All pump installations must have remote pump running and supervisory alarms in a location constantly attended by trained personnel, (usually fire dispatch) as required by NFPA 20. Provide for signal transmission via the base fire alarm system if possible, otherwise over telephone lines.

3. Each pump controller shall have individual pressure sensing lines. All pumps shall be automatic start and manual stop. Automatic shutdown, except upon complete exhaustion of reservoir water, is prohibited.

4. All salt water pumps must have special metallurgy or coating systems in accordance with manufacturer's recommendations.

5. Pump controllers must be a standard commercial product, listed by UL or FM as per NFPA 20. Use of unlisted, custom-built controllers on new installations is prohibited.

6. Provide test headers and flow meters for all pumps. (A common meter and header is acceptable for multiple pumps at same location). Arrange flow meter to discharge through test header to allow for meter calibration. When taking suction from a static source, also arrange the meter to discharge back to source. **Show a minimum straight run of pipe without valves or fittings equal to 10 times the pipe diameter on the intake side of the metering device and 5 times the diameter on the discharge side.**

6.1 Provide an automatic bypass IAW NFPA 20 for all booster fire pump installations, i.e., pumps taking suction from a pressurized source.

7. Do not arrange diesel pumps to start automatically upon AC power failure.

8. For large fire flows, provide multiple pumps rather than one large pump, e.g., two 1500 gpm pumps instead of one 3000 gpm pump. NFPA 409 requires that aircraft hangar fire suppression systems be capable of full operation with the largest single pump out of service. NAVSEA OP-5 requires multiple pumps for explosives facilities, so that at least 50% of the fire flow can be maintained with the largest pump out of service.

9. Fire pumps come in standard sizes of 500, 750, 1000, 1500, 2000, 2500, and 3000 gpm. Except for NFPA 13D sprinkler systems, specify only these standard sizes.

10. Choose pump sizes so that it is not necessary for pumps to operate at more than 125% (preferably 100%) of capacity to satisfy the total fire flow demand.

11. Ensure that water from full-flow pressure relief valves is discharged safely in accordance with NFPA 20. Wasting water to grade shall be done only as a last resort, and only if adequate splash blocks, storm drains, etc. are provided.

12. Ensure that adequate space is provided for access to pumps and controllers for maintenance and emergency manual operation by firefighters. Ensure that each controller is located within sight of the pump it controls.

13. Avoid pump room layouts that require personnel to climb over piping to reach pumps or controllers. If absolutely necessary to climb over obstacles, provide stairs and platforms with non-skid surfaces and handrails and guards in accordance with OSHA regulations.

14. For diesel-engine-driven pumps and generators, ensure that adequate combustion air intakes are provided into the pump room. Combustion air shall not be taken from inside the building. **If supply of combustion air requires electrical power (e.g. to operate dampers or fans), two reliable sources of power with automatic switchover (see Item I.1-A above) must be provided.**

15. Ensure pump and generator foundations are adequate. For diesel-driven pumps or generators which are not located in a separate dedicated building, ensure the foundation provides adequate vibration isolation from the remainder of the building. Also ensure that adequate sound attenuation is provided.

16. Provide a telephone in the pump room for fire department emergency communications. For diesel engine installations, locate the phone just outside the pump room in a weather-tight enclosure for audibility.

J. FIRE HYDRANTS & APPARATUS ACCESS

1. When locating new fire hydrants, place them 3'-7' from the pavement, at least 50' but not more than 300' from the building they are intended to protect. Pumper outlet shall face the pavement.

2. Ensure that there will be at least one hydrant within 350' of each building, and a second within 500'. Distances shall be measured using actual routes of fire apparatus travel over all-weather(paved)surfaces. (The distances being measured are the length of supply hose which must be played off the back of the engine as it drives from the hydrant to the fire, not the length of attack line taken from the engine into the building.) If in doubt about route of travel, contact the base Fire Chief.

2-A. Provide a fire hydrant within 150 feet of every fire department pumper connection (i.e. sprinkler or standpipe) siamese.

3. Ensure that adequate access to a facility is provided for fire apparatus. Consult NFPA 1 or NFPA 1141 for additional details on fire apparatus access roads, a.k.a. “fire lanes”. In those documents, references to the "Fire Chief" shall be interpreted to mean the "EFA Northeast Fire Protection Engineer".

4. At facilities which have both potable and non-potable water systems, fire hydrants must be color coded or otherwise clearly marked as being fed from either the potable or non-potable system, to avoid cross-connections during firefighting. Show this on drawings and specify painting to be done by contractor. Hydrant bonnet and cap color shall comply with NFPA 291 based on flow capacity, unless otherwise directed. Hydrant barrels shall be yellow for potable water and red for non-potable water.

Hydrants at reserve centers and similar facilities shall comply with the requirements of the local municipality.

K. MISCELLANEOUS:

1. Combustible construction (UBC Types III, IV, and V) shall not be used for new construction, except for small, insignificant, light hazard buildings as defined by Mil-Hdbk-1008. Contact the NORTHDIV FPE for approval before using combustible construction.

2. Exposed insulation in concealed spaces of sprinklered buildings must be specified to have a flame spread of 25 or less and a smoke developed rating of 50 or less (including paper covering). This is to prevent the space from being defined as a combustible concealed space which would require sprinkler protection in accordance with NFPA 13. Acceptable types of insulation blankets per Federal Spec HH-521F are Type I, Type II (Class A only), and Type III (Class A only).

3. For the purposes of applying the **Hazardous (Classified) Location** requirements of the NATIONAL ELECTRICAL CODE (NFPA 70), "handling" of class I, II, or IIIA liquids or flammable gasses **shall include placing into, or retrieving from, storage** in warehouses, hazardous waste transfer/minimization facilities, and similar occupancies.

4. High rise buildings are considered to be those buildings more than 75 feet, regardless of the reach of fire department ladders. However, automatic sprinkler systems are required for all buildings greater than 4 stories, per Mil-Hdbk-1008.

5. In areas protected by deluge sprinkler systems, the design must provide protection of electrical equipment and adjacent spaces from system discharge. Specify raintight fire alarm and detection system components, light fixtures that are approved for damp locations, and non-ventilated NEMA Type 4 enclosures for all other non-explosion-proof equipment in spaces subject to discharge from the deluge system. Ensure that walls and ceilings are adequate to prevent entry of water or foam into adjacent spaces. (Adapted from NAVFAC DPL-88-0003.)

6. For materials subject to delamination during a fire (such as plywood), fire retardant paint or brush- or spray-applied coatings applied in the field shall not be considered a substitute for pressure treating with fire retardant chemicals at the factory.

7. Do not use fire retardant treated wood in lieu of required noncombustible materials. Fire retardant wood shall not be considered noncombustible.

8. Do not provide fire hose for occupant use, except where required by NFPA Standard (e.g. NFPA 231, 231C, or 409).

9. Use NORTHDIV regional guide spec N-10520 for all projects which include provision of fire extinguishers and/or cabinets.

10. For roofs, the following criteria applies:

a. On new metal roof decks, the entire deck assembly shall be specified as being Factory

Mutual Class I or Underwriters Laboratories Fire Classified, unless the building is fully sprinklered (including sprinklers at the underside of the roof deck in addition to sprinklers throughout all occupied spaces of the building). This also applies to re-roofing existing Class I or Fire Classified decks.

b. For re-roofing existing nonconforming metal roof decks, roofing components (insulation, underlayment, etc) shall be specified as having a maximum flame spread rating of 75 and a maximum smoke-development rating of 150 in accordance with ASTM E-84.

c. Roof coverings (regardless of roof type) shall have a Class A or Class B rating by UL, except Class C coverings will be permitted on insignificant buildings under 8,000 square feet with negligible potential fire exposure sources.

d. For additional information on roofs, consult Mil-Hdbk-1008.

NOTE: The rating of Class A, B, or C refers to the exterior resistance of the roof covering to ignition from burning brands.

Factory Mutual Class I or II, and UL "Fire Classified" ratings are measures of the resistance of the entire roof assembly to ignition from exposure to a fire within the building heating the underside of the roof deck. These two ratings cannot be equated and are NOT interchangeable!

L. LIFE SAFETY CODE ISSUES

1. FLAMMABLE LIQUID WAREHOUSES, HAZARDOUS MATERIALS TRANSFER FACILITIES, AND SIMILAR OCCUPANCIES WHERE FLAMMABLE LIQUIDS and/or gasses are stored or handled shall be considered "high hazard" occupancies for the purpose of determining Life Safety Code requirements. NOTE: "**Handling" shall include placing and retrieving containers from storage** in such occupancies.

2. Exterior exits (stairways, balconies, etc.) shall be enclosed with non-combustible material to prevent snow and ice accumulation as required by NFPA 101.

M EDITORIAL NOTES

Additions to this document made since the previous edition are highlighted in this manner.